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ARITHMETIC.

Conducted by B. F. FINKEL, Springfield, Mo. All contributions to this department should be sent to him.

SOLUTIONS OF PROBLEMS.

71. Proposed by **J. A. CALDERHEAD, M. Sc.**, Professor of Mathematics in Curry University, Pittsburg, Pennsylvania.

A man owes me \$200 due in 2 years, and I owe him \$100 due in 4 years; when can he pay me \$100 to settle the account equitably, money being worth 6%?

I. Solution by **P. S. BERG**, Principal of Schools, Larimore, North Dakota; and the **PROPOSER**.

Let x=the time.

Now, the present worth of \$200 for $(2-x)$ years—the present worth of \$100 for $(4-x)$ years must=\$100.

$\dfrac{10000}{56-3x}$=present worth of \$200 for $(2-x)$ years at 6%.

$\dfrac{5000}{62-3x}$=present worth of \$100 for $(4-x)$ years at 6%.

$$\therefore \frac{10000}{56-3x}-\frac{5000}{62-3x}=100.$$

$\therefore$ x=.358615 years=4 months and 9 days.

II. Solution by **FREDERIC R. HONEY**, New Haven, Connecticut.

The present value of \$1.12 due 2 years hence is \$1.00. Therefore the present value of \$200.00 due in 2 years is \$200÷1.12=\$178.571. The present value of \$1.24 due 4 years hence is \$1.00. Therefore the present value of \$100.00 due 4 years hence is \$100÷1.24=\$80.645. If we deduct \$80.645 from \$178.571 we have \$97.926, the amount due to me at the present time. This sum placed at interest at 6% would yield \$97.926 × .06=\$5.876 in 1 year. The difference between \$100.00 and \$97.926 is \$2.074, the interest which must accumulate in order that the sum may become equal to \$1.00. Therefore since the interest \$5.876 accumulates in 1 year, the interest \$2.074 will accumulate in 2.074÷5.876=0.3529 years. Answer.

72. Proposed by **W. H. CARTER**, Professor of Mathematics, Centenary College of Louisiana, Jackson, Louisiana.

Though the length of my field is 1-7 longer than my neighbor's, and its quality is 1-9 better, yet as its breadth is 1-4 less, his is worth \$500 more than mine. What is mine worth? *Encyclopedia Britannica.*

Solution by Misses **EVA JONES** and **NEVA CAROTHERS**, Senior Pupils of West Point Graded School.

1. $l:l'::7:8$. 1st condition.

2. $q:q'::9:10$. 2nd condition.

3. $b : b' :: 4 : 3$. 3rd condition.

4. $v : v' :: 21 : 21$, multiplying and reducing, and remembering that the value $\propto l.b.q$.

5. Also $v-v'=\$500$. Whence,

6. $v=\$10500$. From (4) and (5),

7. $v'=\$10000$.

This problem was also solved by *B. F. SINE*, *NELSON S. RORAY*, *P. S. BERG*, *F. M. McGAW*, *J. C. CORBIN*, *COOPER D. SCHMITT*, *FREDERIC R. HONEY*, *H. C. WILKES*, and *G. B. M. ZERR*.

M. A. Gruber sent in a solution of Problem 70, Department of Arithmetic, too late for credit in last issue. His answer is 6.48 years.

ALGEBRA.

Conducted by J. M. COLAW, Monterey, Va. All contributions to this department should be sent to him.

SOLUTIONS OF PROBLEMS.

68. Proposed by ROBERT JUDSON ALEY, M. A., Professor of Mathematics in Indiana University, Bloomington, Indiana.

Sum to n terms the series, $n\cos\theta+(n-1)\cos2\theta+(n-2)\cos3\theta$, etc.

[*Chrystal's Algebra.*]

I. Solution by O. W. ANTHONY, M. Sc., Professor of Mathematics in Columbian University, Washingten, D. C.

Let $S=n\cos\theta+(n-1)\cos2\theta+(n-2)\cos3\theta\ldots\ldots\ldots$ Also let $S_s=\sin\theta+\sin2\theta+\sin3\theta\ldots\ldots\ldots$, and $S_c=\cos\theta+\cos2\theta+\cos3\theta\ldots\ldots\ldots$

$$S=n[\cos\theta+\cos2\theta+\cos3\theta+\ldots\ldots\ldots]-[\cos2\theta+2\cos3\theta+\ldots\ldots\ldots],$$

$$=(n+1)[\cos\theta+\cos2\theta+\cos3\theta+\ldots\ldots\ldots]-[\cos\theta+2\cos2\theta+3\cos3\theta\ldots\ldots\ldots],$$

$$=(n+1)S_c-dS_s/d\theta.$$

Now $S_c=[\cos\{\frac{1}{2}(n+1).\theta\}\sin\frac{1}{2}(n\theta)]/\sin\frac{1}{2}\theta$, and $S_s=[\sin\{\frac{1}{2}(n+1).\theta\}\sin\frac{1}{2}(n\theta)]/\sin\frac{1}{2}\theta$.

$$\therefore\ S=(n+1)\frac{\cos\{\frac{1}{2}(n+1)\theta\}\sin\frac{1}{2}(n\theta)}{\sin\frac{1}{2}\theta}-\frac{d}{d\theta}\left[\frac{\sin\frac{1}{2}(n+1).\theta\sin\frac{1}{2}(n\theta)}{\sin\frac{1}{2}\theta}\right],$$

probably as compact a form as can be obtained.

II. Solution by G. B. M. ZERR, A. M., Ph. D., Texarkana, Arkansas.

Let S=sum required,

$$2\sin\tfrac{1}{2}\theta\cos n\theta=\sin\{\theta+\frac{2n-1}{2}\theta\}-\sin\{\theta+\frac{2n-3}{2}\theta\}$$